

SEQUENCE LISTING

5 <110> Moyle, William R.
 Xing, Yongna
 <120> Protein Knobs
 <130> 268/279-RWJ-01-40
 10 <140> 60/345,283
 <141> 2001-11-08
 <160> 56
 15 <170> PatentIn version 3.1
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 35 40 45
 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60
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 65 70 75 80
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 85 90
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 55 1 5 10 15
 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30
 60 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45
 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

5 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

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 15 <400> 3

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 1 5 10 15

20 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 25 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

30 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

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 45 <400> 4

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Cys Pro
 1 5 10 15

50 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

55 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 60 65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

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 15 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15
 Cys Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30
 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 25 35 40 45
 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60
 25 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80
 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90
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 40 <400> 6

 45 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15
 Phe Phe Ser Gln Pro Cys Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30
 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45
 50 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60
 55 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80
 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90
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1 5 10 15

10

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Cys Cys Met Gly Cys Cys
20 25 30

15

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
50 55 60

20

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
85 90

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<210> 8

<211> 92

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<400> 8

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1 5 10 15

40

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
35 40 45

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
50 55 60

50

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
85 90

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<400> 9

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

Phe Ser Cys Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

<210> 10

<211> 92

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<400> 10

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

Phe Ser Arg Ala Cys Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

<210> 11

<211> 92

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<400> 11

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
20 25 30

Phe Ser Arg Ala Tyr Cys Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
85 90

<210> 12

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<400> 12

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
20 25 30

Phe Ser Arg Ala Tyr Pro Cys Pro Leu Arg Ser Lys Lys Thr Met Leu
35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
85 90

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 <400> 13

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 1 5 10 15

 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

 20 Phe Ser Arg Ala Tyr Pro Thr Cys Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

 25 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

 30 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90
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 45 <400> 14

 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

 50 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

 55 Phe Ser Arg Ala Tyr Pro Thr Pro Cys Arg Ser Lys Lys Thr Met Leu
 35 40 45

 60 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr

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65              70              75              80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
5              85              90

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Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
20 1              5              10              15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
25 20              25              30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Cys Ser Lys Lys Thr Met Leu
30 35              40              45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
35 50              55              60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
40 65              70              75              80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
45              85              90

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<400> 16

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
55 1              5              10              15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
60 20              25              30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Cys Lys Lys Thr Met Leu
65 35              40              45

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Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

5 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

10 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

15 <210> 17
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 <400> 17

25 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

30 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Cys Lys Thr Met Leu
 35 40 45

35 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

40 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

45 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

50 <210> 18
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55 <220>
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 <400> 18

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

60 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Cys Thr Met Leu
 35 40 45

5

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

10

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

15

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

20

<210> 19
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<220>
 <223> hCG alpha subunit with Cys substituted for Thr46
 <400> 19

30

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

35

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

40

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Cys Met Leu
 35 40 45

45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

50

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

55

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

60

<210> 20
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<220>
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 <400> 20

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

5 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

10 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Cys Leu
 35 40 45

15 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

20 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

25 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

<210> 21
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30 <220>
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 <400> 21

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 1 5 10 15

40 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

45 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Cys
 35 40 45

50 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

55 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

60 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

<210> 22
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 <212> PRT
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<220>
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<400> 22

5 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
1 5 10 15

10 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
20 25 30

15 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
35 40 45

20 Cys Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
50 55 60

25 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
85 90

<210> 23

<211> 92

30 <212> PRT

<213> Artificial Sequence

<220>

35 <223> hCG alpha-subunit with Cys substituted for Gln50

<400> 23

40 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
20 25 30

45 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
35 40 45

50 Val Cys Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
50 55 60

55 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
85 90

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<210> 24

<211> 92

<212> PRT
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<220>

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<400> 24

10 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

15 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

20 Val Gln Cys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

25 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

30 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

<210> 25

<211> 92

35 <212> PRT

<213> Artificial Sequence

<220>

40 <223> hCG alpha-subunit with Cys substituted for Asn52

<400> 25

45 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

50 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

55 Val Gln Lys Cys Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

60 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser

85

90

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 10 <220>
 <223> hCG alpha-subunit with Cys substituted for Val53

 <400> 26

 15 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 20 25 30

 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

 25 Val Gln Lys Asn Cys Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

 30 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

 35 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

 40 <210> 27
 <211> 92
 <212> PRT
 <213> Artificial Sequence

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 45 <400> 27

 50 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

 55 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

 60 Val Gln Lys Asn Val Thr Ser Cys Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

5 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

10 <210> 28
 <211> 92
 <212> PRT
 <213> Artificial Sequence

15 <220>
 <223> hCG alpha-subunit with Cys substituted for Ser64

<400> 28

20 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

25 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

30 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Cys Ser
 50 55 60

35 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

40 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

45 <210> 29
 <211> 92
 <212> PRT
 <213> Artificial Sequence

50 <220>
 <223> hCG alpha-subunit with Cys substituted for Val76

<400> 29

55 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

60 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

5

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Cys Glu Asn His Thr
 65 70 75 80

10

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

15

<210> 30
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 <212> PRT
 <213> Artificial Sequence

20

<220>
 <223> hCG alpha-subunit with Cys substituted for Thr86
 <400> 30

25

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

30

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

35

Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

40

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

45

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

50

Ala Cys His Cys Ser Cys Cys Tyr Tyr His Lys Ser
 85 90

55

<210> 31
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 <212> PRT
 <213> Artificial Sequence
 <220>
 <223> hCG alpha-subunit with Cys substituted for Tyr88
 <400> 31

60

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

5 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

10 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

15 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

20 Ala Cys His Cys Ser Thr Cys Cys Tyr His Lys Ser
 85 90

25 <210> 32
 <211> 92
 <212> PRT
 <213> Artificial Sequence

30 <220>
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 <400> 32

35 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

40 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

45 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

50 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

55 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

60 Ala Cys His Cys Ser Thr Cys Tyr Cys His Lys Ser
 85 90

65 <210> 33
 <211> 92
 <212> PRT
 <213> Artificial Sequence

70 <220>
 <223> hCG alpha-subunit with Cys substituted for His90
 <400> 33

Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro

18/41

<223> hCG alpha-subunit with Cys substituted for Ser92

<400> 35

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5  Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
   1              5              10              15

10 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
   20              25              30

15 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
   35              40              45

20 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
   50              55              60

   Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
   65              70              75              80

25 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Cys
   85              90

30 <210> 36
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   <212> PRT
   <213> Homo sapiens

35 <400> 36

   Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
   1              5              10              15

40 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
   20              25              30

45 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
   35              40              45

50 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
   50              55              60

   Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
   65              70              75              80

55 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
   85              90              95

60 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
   100              105              110

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Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

5 Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140

10 <210> 37
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15 <220>
 <223> hCG beta-subunit with Cys substituted for Ser138
 <400> 37

20 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15

25 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30

30 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45

35 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60

40 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
 65 70 75 80

45 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
 85 90 95

50 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110

55 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

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55 <210> 38
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 eta-subunit counterparts, namely hFSH beta-subunit residues 95-10
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<400> 38

5 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15

 10 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30

 15 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45

 20 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60

 25 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80

 30 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
 85 90 95

 35 Thr Thr Asp Cys Thr Val Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe
 100 105 110

 40 Gly Glu Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

 45 Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140

40 <210> 39
 <211> 145
 <212> PRT
 <213> Artificial Sequence

45 <220>
 <223> hCG beta-subunit residues 101-114 were replaced with their hFSH b
 eta-subunit counterparts, namely hFSH beta-subunit residues 95-10
 8, and Serine38 in the beta-subunit carboxyterminus of this
 analog was replaced with Cys

<400> 39

55 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15

 60 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30

 65 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60
 5
 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80
 10 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
 85 90 95
 15 Thr Thr Asp Cys Thr Val Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe
 100 105 110
 Gly Glu Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125
 20 Pro Ser Pro Ser Arg Leu Pro Gly Pro Cys Asp Thr Pro Ile Leu Pro Gln
 130 135 140
 25
 <210> 40
 <211> 111
 <212> PRT
 <213> Homo sapiens
 30
 <400> 40
 Asn Ser Cys Glu Leu Thr Asn Ile Thr Ile Ala Val Glu Lys Glu Gly
 1 5 10 15
 35 Cys Gly Phe Cys Ile Thr Ile Asn Thr Thr Trp Cys Ala Gly Tyr Cys
 20 25 30
 40 Tyr Thr Arg Asp Leu Val Tyr Lys Asp Pro Ala Arg Pro Lys Ile Gln
 35 40 45
 45 Lys Thr Cys Thr Phe Lys Glu Leu Val Tyr Glu Thr Val Arg Val Pro
 50 55 60
 50 Gly Cys Ala His His Ala Asp Ser Leu Tyr Thr Tyr Pro Val Ala Thr
 65 70 75 80
 Gln Cys His Cys Gly Lys Cys Asp Ser Asp Ser Thr Asp Cys Thr Val
 85 90 95
 55 Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe Gly Glu Met Lys Glu
 100 105 110
 60
 <210> 41
 <211> 139
 <212> PRT

<213> Artificial Sequence

<220>

<223> hFSH beta-subunit analog lacking the leader peptide of hFSH beta-subunit with hFSH residues 1-108 and hCG residues 115-145 in tandem

<400> 41

10 Asn Ser Cys Glu Leu Thr Asn Ile Thr Ile Ala Val Glu Lys Glu Gly
1 5 10 15

15 Cys Gly Phe Cys Ile Thr Ile Asn Thr Thr Trp Cys Ala Gly Tyr Cys
20 25 30

20 Tyr Thr Arg Asp Leu Val Tyr Lys Asp Pro Ala Arg Pro Lys Ile Gln
35 40 45

Lys Thr Cys Thr Phe Lys Glu Leu Val Tyr Glu Thr Val Arg Val Pro
50 55 60

25 Gly Cys Ala His His Ala Asp Ser Leu Tyr Thr Tyr Pro Val Ala Thr
65 70 75 80

30 Gln Cys His Cys Gly Lys Cys Asp Ser Asp Ser Thr Asp Cys Thr Val
85 90 95

35 Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe Gly Glu Phe Gln Asp Ser
100 105 110

40 Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu Pro Ser Pro Ser Arg Leu
115 120 125

Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
130 135

45

<210> 42

<211> 137

<212> PRT

<213> Artificial Sequence

50

<220>

<223> hFSH beta-subunit analog lacking the leader peptide of hFSH beta-subunit with hFSH residues 1-108 and hCG residues 115-145 in tandem and with Ser132 replaced with Cys

55

<400> 42

60 Asn Ser Cys Glu Leu Thr Asn Ile Thr Ile Ala Val Glu Lys Glu Gly
1 5 10 15

Cys Gly Phe Cys Ile Thr Ile Asn Thr Thr Trp Cys Ala Gly Tyr Cys
20 25 30

Tyr Thr Arg Asp Leu Val Tyr Lys Asp Pro Ala Arg Pro Lys Ile Gln
 35 40 45
 5
 Lys Thr Cys Thr Phe Lys Glu Leu Val Tyr Glu Thr Val Arg Val Pro
 50 55 60
 10
 Gly Cys Ala His His Ala Asp Ser Leu Tyr Thr Tyr Pro Val Ala Thr
 65 70 75 80
 15
 Gln Cys His Cys Gly Lys Cys Asp Ser Asp Ser Thr Asp Cys Thr Val
 85 90 95
 20
 Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe Gly Glu Phe Gln Asp Ser
 100 105 110
 25
 Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu Pro Ser Pro Ser Arg Leu
 115 120 125
 30
 Pro Gly Pro Cys Asp Thr Pro Ile Leu
 130 135
 35
 <210> 43
 <211> 401
 <212> PRT
 <213> Artificial Sequence
 40
 <220>
 <223> hCGbeta,S138C-betaLA(short), beta-lactamase fused to a truncated
 version of hCGbeta,S138C
 45
 <400> 43
 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15
 50
 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30
 55
 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45
 60
 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60
 65
 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
 65 70 75 80
 70
 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
 85 90 95

5 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110
 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125
 10 Pro Ser Pro Ser Arg Leu Pro Gly Pro Cys Asp His Pro Glu Thr Leu
 130 135 140
 15 Val Lys Val Lys Asp Ala Glu Asp Gln Leu Gly Ala Arg Val Gly Tyr
 145 150 155 160
 20 Ile Glu Leu Asp Leu Asn Ser Gly Lys Ile Leu Glu Ser Phe Arg Pro
 165 170 175
 25 Glu Glu Arg Phe Pro Met Met Ser Thr Phe Lys Val Leu Leu Cys Gly
 180 185 190
 Ala Val Leu Ser Arg Ile Asp Ala Gly Gln Glu Gln Leu Gly Arg Arg
 195 200 205
 30 Ile His Tyr Ser Gln Asn Asp Leu Val Glu Tyr Ser Pro Val Thr Glu
 210 215 220
 35 Lys His Leu Thr Asp Gly Met Thr Val Arg Glu Leu Cys Ser Ala Ala
 225 230 235 240
 40 Ile Thr Met Ser Asp Asn Thr Ala Ala Asn Leu Leu Leu Thr Thr Ile
 245 250 255
 45 Gly Gly Pro Lys Glu Leu Thr Ala Phe Leu His Asn Met Gly Asp His
 260 265 270
 Val Thr Arg Leu Asp Arg Trp Glu Pro Glu Leu Asn Glu Ala Ile Pro
 275 280 285
 50 Asn Glu Arg Asp Thr Thr Met Pro Val Ala Met Ala Thr Thr Leu Arg
 290 295 300
 55 Lys Leu Leu Thr Gly Glu Leu Leu Thr Leu Ala Ser Arg Gln Gln Leu
 305 310 315 320
 60 Ile Asp Trp Met Glu Ala Asp Lys Val Ala Gly Pro Leu Leu Arg Ser
 325 330 335
 Ala Leu Pro Ala Gly Trp Phe Ile Ala Asp Lys Ser Gly Ala Gly Glu
 340 345 350

5 Arg Gly Ser Arg Gly Ile Ile Ala Ala Leu Gly Pro Asp Gly Lys Pro
 355 360 365
 Ser Arg Ile Val Val Ile Tyr Thr Thr Gly Ser Gln Ala Thr Met Asp
 370 375 380
 10 Glu Arg Asn Arg Gln Ile Ala Glu Ile Gly Ala Ser Leu Ile Lys His
 385 390 395 400
 15 Trp
 20 <210> 44
 <211> 408
 <212> PRT
 <213> Artificial Sequence
 25 <220>
 <223> hCGBeta,S138C-betaLA(long), beta-lactamase fused to the carboxy-
 terminal end of hCGB,S138C
 <400> 44
 30 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15
 35 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30
 40 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45
 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60
 45 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
 65 70 75 80
 50 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
 85 90 95
 55 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110
 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125
 60 Pro Ser Pro Ser Arg Leu Pro Gly Pro Cys Asp Thr Pro Ile Leu Pro
 130 135 140

5	Gln 145	His	Pro	Glu	Thr	Leu 150	Val	Lys	Val	Lys	Asp 155	Ala	Glu	Asp	Gln	Leu 160
10	Gly	Ala	Arg	Val	Gly 165	Tyr	Ile	Glu	Leu	Asp 170	Leu	Asn	Ser	Gly	Lys 175	Ile
15	Leu	Glu	Ser	Phe 180	Arg	Pro	Glu	Glu	Arg 185	Phe	Pro	Met	Met	Ser	Thr	Phe
20	Lys	Val	Leu 195	Leu	Cys	Gly	Ala	Val 200	Leu	Ser	Arg	Ile	Asp 205	Ala	Gly	Gln
25	Glu	Gln 210	Leu	Gly	Arg	Arg	Ile 215	His	Tyr	Ser	Gln	Asn 220	Asp	Leu	Val	Glu
30	Tyr 225	Ser	Pro	Val	Thr	Glu 230	Lys	His	Leu	Thr	Asp 235	Gly	Met	Thr	Val	Arg 240
35	Glu	Leu	Cys	Ser	Ala 245	Ala	Ile	Thr	Met	Ser 250	Asp	Asn	Thr	Ala	Ala 255	Asn
40	Leu	Leu	Leu	Thr 260	Thr	Ile	Gly	Gly	Pro 265	Lys	Glu	Leu	Thr	Ala	Phe	Leu
45	His	Asn	Met 275	Gly	Asp	His	Val 280	Thr	Arg	Leu	Asp	Arg	Trp 285	Glu	Pro	Glu
50	Leu	Asn 290	Glu	Ala	Ile	Pro	Asn 295	Asp	Glu	Arg	Asp	Thr 300	Thr	Met	Pro	Val
55	Ala	Met	Ala	Thr	Thr	Leu	Arg 310	Lys	Leu	Leu	Thr 315	Gly	Glu	Leu	Leu	Thr 320
60	Leu	Ala	Ser	Arg	Gln 325	Gln	Leu	Ile	Asp 330	Trp	Met	Glu	Ala	Asp	Lys 335	Val
65	Ala	Gly	Pro	Leu 340	Leu	Arg	Ser	Ala	Leu 345	Pro	Ala	Gly	Trp	Phe	Ile	Ala
70	Asp	Lys	Ser 355	Gly	Ala	Gly	Glu	Arg	Gly 360	Ser	Arg	Gly	Ile	Ile	Ala	Ala
75	Leu	Gly 370	Pro	Asp	Gly	Lys	Pro 375	Ser	Arg	Ile	Val	Val 380	Ile	Tyr	Thr	Thr
80	Gly	Ser	Gln	Ala	Thr	Met	Asp	Glu	Arg	Asn	Arg	Gln	Ile	Ala	Glu	Ile

385

390

395

400

5 Gly Ala Ser Leu Ile Lys His Trp
405

<210> 45

<211> 125

10 <212> PRT

<213> Artificial Sequence

<220>

15 <223> hCGbeta,delta116-135,S138C

<400> 45

20 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
20 25 30

25 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
35 40 45

30 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
50 55 60

35 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
65 70 75 80

40 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
85 90 95

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
100 105 110

45 Pro Arg Phe Gly Pro Cys Asp Thr Pro Ile Leu Pro Gln
115 120

50 <210> 46
<211> 130
<212> PRT
<213> Artificial Sequence

55 <220>
<223> hCGbeta,delta121-135,S138C

<400> 46

60 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
1 5 10 15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
20 25 30

5 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
35 40 45

10 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
50 55 60

15 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
65 70 75 80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
85 90 95

20 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
100 105 110

25 Pro Arg Phe Gln Asp Ser Ser Ser Gly Pro Cys Asp Thr Pro Ile Leu
115 120 125

30 Pro Gln

<210> 47
<211> 136
35 <212> PRT
<213> Artificial Sequence

<220>
40 <223> hCGbeta,delta126-135,S138C

<400> 47

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
1 5 10 15

45 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
20 25 30

50 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
35 40 45

55 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
50 55 60

60 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Asn Pro Val Val
65 70 75 80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser

30/41

<212> PRT
 <213> Artificial Sequence

<220>

5 <223> hCG alpha-subunit, Lys91 replaced with Glu

<400> 49

10 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

15 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

20 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

25 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

30 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Glu Ser
 85 90

<210> 50

<211> 92

35 <212> PRT

<213> Artificial Sequence

<220>

40 <223> hCG alpha-subunit loop 2, Lys91 replaced with Met

<400> 50

45 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

50 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45

55 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

60 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

Ala Cys His Cys Ser Thr Cys Tyr Tyr His Met Ser

85

90

5 <210> 51
 <211> 92
 <212> PRT
 <213> Artificial Sequence

 10 <220>
 <223> hCG alpha-subunit loop 2, Lys44 replaced with Ala

 <400> 51

 15 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 20 25 30

 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Ala Lys Thr Met Leu
 35 40 45

 25 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

 30 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

 35 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

 40 <210> 52
 <211> 92
 <212> PRT
 <213> Artificial Sequence

 <220>
 45 <223> hCG alpha-subunit loop 2, Lys44 replaced with Glu and Lys45 replaced with Gln

 <400> 52

 50 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 55 20 25 30

 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Glu Gln Thr Met Leu
 35 40 45

 60 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

5
 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

10
 <210> 53
 <211> 92
 <212> PRT
 <213> Artificial Sequence

15
 <220>
 <223> hCG alpha-subunit loop 2, Lys44 replaced with Arg
 <400> 53

20
 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15

25
 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 25 30

30
 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Arg Lys Thr Met Leu
 35 40 45

35
 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 50 55 60

40
 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80

45
 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 85 90

50
 <210> 54
 <211> 139
 <212> PRT
 <213> Artificial Sequence
 <220>
 <223> hCG analog - beta101-145, alpha, residues 3-100 deleted from hCG
 beta-subunit with alpha-subunit fused to the end of the remaining
 beta-subunit
 <400> 54

55
 Ser Lys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp Pro Arg
 1 5 10 15

60
 Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu Pro Ser
 20 25 30

Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln Ala
 35 40 45

5 Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro Phe
 50 55 60

10 Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys Phe
 65 70 75 80

15 Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu Val
 85 90 95

Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser Tyr
 100 105 110

20 Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr Ala
 115 120 125

25 Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser
 130 135

30 <210> 55
 <211> 31
 <212> PRT
 <213> Homo sapiens

35 <400> 55
 Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu Pro Ser
 1 5 10 15

40 Pro Ser Arg Leu Pro Gly Pro Ser Thr Asp Pro Ile Leu Pro Gly
 20 25 30

45 <210> 56
 <211> 10
 <212> PRT
 <213> Artificial Sequence

50 <220>
 <223> Xl-Asp-Asp-Asp-Asp-Lys-Ser-Ym-Cys-Zn, where X, Y, and Z refer to
 any tail portion amino acids and l, m, and n refer to the lengths
 of the tail portion amino acids

55 <220>
 <221> MISC_FEATURE
 <223> Xaa refers to any tail portion amino acids and n refers to the
 lengths of the tail portion amino acids

60 <400> 56
 Xaa_n Asp Asp Asp Asp Lys Ser Xaa_n Cys Xaa_n

1 5 10

5 <210> 57
 <211> 92
 <212> PRT
 <213> Artifical Sequence

10 <220>
 <223> An hCG truncated β -subunit analog fused to the hCG alpha-carboxyterminus
 <400> 57

15 Ala Pro Asp Val Gln Asp Cys Pro Glu Cys Thr Leu Gln Glu Asn Pro
 1 5 10 15
 Phe Phe Ser Gln Pro Gly Ala Pro Ile Leu Gln Cys Met Gly Cys Cys
 20 20 25 30
 Phe Ser Arg Ala Tyr Pro Thr Pro Leu Arg Ser Lys Lys Thr Met Leu
 35 40 45
 Val Gln Lys Asn Val Thr Ser Glu Ser Thr Cys Cys Val Ala Lys Ser
 25 50 55 60
 Tyr Asn Arg Val Thr Val Met Gly Gly Phe Lys Val Glu Asn His Thr
 65 70 75 80
 30 Ala Cys His Cys Ser Thr Cys Tyr Tyr His Lys Ser Asp Asp Pro Arg
 85 90 95
 Phe Gly Pro Cys Asp Thr Pro Ile Leu Pro Gln
 100 105

35
 <210> 58
 <211> 145
 <212> PRT
 <213> Artificial Sequence

40 <220>
 <223> hCG beta-subunit with Cys substituted for Arg94
 <400> 58

45 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15
 50 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30
 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 55 35 40 45
 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60

60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80

5 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Cys Arg Ser
 85 90 95

10 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110

15 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140

20

<210> 59
 <211> 145
 <212> PRT
 <213> Artificial Sequence

25

<220>
 <223> hCG beta-subunit with Cys substituted for Arg95

30 <400> 59

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15

35 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30

40 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60

45

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80

50

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Cys Ser
 85 90 95

55 Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110

60 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140

5

<210> 60
 <211> 145
 <212> PRT
 <213> Artificial Sequence

10

<220>
 <223> hCG beta-subunit with Cys substituted for Ser96

<400> 60

15

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15

20

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30

25

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45

30

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80

35

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Cys
 85 90 95

40

Thr Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110

45

Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140

50

<210> 61
 <211> 145
 <212> PRT
 <213> Artificial Sequence

55

<220>
 <223> hCG beta-subunit with Cys substituted for Thr97

<400> 61

60

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15
 5 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30
 10 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45
 15 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60
 20 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80
 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
 85 90 95
 25 Cys Thr Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
 100 105 110
 30 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125
 35 Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140
 <210> 62
 <211> 145
 <212> PRT
 <213> Artificial Sequence
 40
 <220>
 <223> hCG beta-subunit with Cys substituted for Thr98
 <400> 62
 45 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15
 50 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30
 55 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45
 60 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60
 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val

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65              70              75              80
5  Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
    85              90              95

10 Thr Cys Asp Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
    100              105              110

15 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
    115              120              125

20 Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
    130              135              140

<210> 63
<211> 145
<212> PRT
<213> Artificial Sequence

<220>
25 <223> hCG beta-subunit with Cys substituted for Asp99

<400> 63

30 Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
    1          5          10          15

35 Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
    20          25          30

40 Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
    35          40          45

45 Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
    50          55          60

45 Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
    65          70          75          80

50 Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Ser
    85              90              95

55 Thr Thr Cys Cys Gly Gly Pro Lys Asp His Pro Leu Thr Cys Asp Asp
    100              105              110

60 Pro Arg Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
    115              120              125

60 pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
    130              135              140

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<210> 64

<211> 95

<212> PRT

5 <213> Artifical Sequence

<220>

<223> An hCG alpha-subunit analog with Gly-Gly-Cys at its carboxyterminus

10 <400> 64

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn	Pro
1				5					10					15	

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys	Cys
			20					25					30		

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met	Leu
		35					40					45			

Val	Gln	Lys	Asn	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys	Ser
	50					55					60				

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His	Thr
25	65				70					75				80	

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser	Gly	Gly	Cys	
				86					90					95	

30

<210> 65

<211> 92

<212> PRT

<213> Artifical Sequence

35

<220>

<223> An hCG alpha-subunit analog with Asp in place of Asn52 and Cys in place of Ser92

40 <400> 65

Ala	Pro	Asp	Val	Gln	Asp	Cys	Pro	Glu	Cys	Thr	Leu	Gln	Glu	Asn	Pro
1				5					10					15	

Phe	Phe	Ser	Gln	Pro	Gly	Ala	Pro	Ile	Leu	Gln	Cys	Met	Gly	Cys	Cys
			20					25					30		

Phe	Ser	Arg	Ala	Tyr	Pro	Thr	Pro	Leu	Arg	Ser	Lys	Lys	Thr	Met	Leu
		35					40					45			

Val	Gln	Lys	Asp	Val	Thr	Ser	Glu	Ser	Thr	Cys	Cys	Val	Ala	Lys	Ser
	50					55					60				

Tyr	Asn	Arg	Val	Thr	Val	Met	Gly	Gly	Phe	Lys	Val	Glu	Asn	His	Thr
55	65				70					75				80	

Ala	Cys	His	Cys	Ser	Thr	Cys	Tyr	Tyr	His	Lys	Ser				
				87					90						

60

<210> 66
 <211> 145
 <212> PRT
 <213> Artificial Sequence

5

<220>
 <223> hCG beta-subunit with Cys substituted for Ser96 and hFSH beta-subunit residues 95-108 for hCG beta-subunit residues 101-108

10

<400> 66

Ser Lys Glu Pro Leu Arg Pro Arg Cys Arg Pro Ile Asn Ala Thr Leu
 1 5 10 15

15

Ala Val Glu Lys Glu Gly Cys Pro Val Cys Ile Thr Val Asn Thr Thr
 20 25 30

20

Ile Cys Ala Gly Tyr Cys Pro Thr Met Thr Arg Val Leu Gln Gly Val
 35 40 45

25

Leu Pro Ala Leu Pro Gln Val Val Cys Asn Tyr Arg Asp Val Arg Phe
 50 55 60

30

Glu Ser Ile Arg Leu Pro Gly Cys Pro Arg Gly Val Pro Asn Val Val
 65 70 75 80

Ser Tyr Ala Val Ala Leu Ser Cys Gln Cys Ala Leu Cys Arg Arg Cys
 85 90 95

35

Thr Thr Asp Cys Thr Val Arg Gly Leu Gly Pro Ser Tyr Cys Ser Phe
 100 105 110

40

Gly Glu Phe Gln Asp Ser Ser Ser Ser Lys Ala Pro Pro Pro Ser Leu
 115 120 125

45

Pro Ser Pro Ser Arg Leu Pro Gly Pro Ser Asp Thr Pro Ile Leu Pro Gln
 130 135 140